

Date: Mon, 27 Apr 1998 12:02:35 -0700 (PDT)
From: "Derek C. Richardson" <dcr@hermes.astro.washington.edu>
Reply-To: "Derek C. Richardson" <dcr@hermes.astro.washington.edu>
To: William Bottke <bottke@astrosun.tn.cornell.edu>
cc: "Stanley G. Love" <love@huey.jpl.nasa.gov>
Subject: Abstract for CD-workshop
MIME-Version: 1.0

OK here's my abstract, virtually identical to the Icarus paper with the exception of the end of the last paragraph. Let me know if it's ok!

Tidal Distortion and Disruption of Rubble-Pile Asteroids: Method and Results

D. C. Richardson (U. Washington), W. F. Bottke (Cornell U.), S. G. Love (JPL)

We present results of numerical simulations that show Earth's tidal forces can both distort and disrupt Earth-crossing asteroids (ECAs) that have weak "rubble-pile" structures. Building on previous studies, we consider more realistic asteroid shapes and trajectories, test a variety of spin rates and axis orientations, and employ a dissipation algorithm to treat more accurately collisions between the particles that make up the model asteroid. We explore a large parameter space, including the asteroid's periape q , encounter velocity with the Earth v_{∞} , spin period P , initial spin axis orientation, and body orientation at periape.

We parameterize the simulation outcomes by the amount of mass stripped from the asteroid during a flyby. Our most severe disruptions result in fragment trains similar in character to the "string of pearls" created when Comet D/Shoemaker-Levy 9 was disrupted near Jupiter in 1992. Less catastrophic disruptions cause material to be stripped off in more isotropic fashion, leaving a central remnant with a characteristic distorted shape. Some ejecta can enter into stable orbits around the remnant, creating a binary or multiple system. Even when no mass is lost tidal forces and torques can modify the asteroid's shape and spin.

Our results show that mass loss is enhanced for small values of q , v_{∞} , and P , and depends to a certain extent on the body's initial spin orientation (for example, retrograde rotation reduces mass loss). An elongated asteroid was found to be far easier to disrupt than a spherical one, though the orientation of the ellipsoid at periape can noticeably change the outcome. Applications of this technique towards an understanding of doublet craters, crater chains, and asteroids with peculiar shapes and spins are discussed by Bottke et al. (this issue).

-- -- -- Derek C. Richardson Tel: (206) 543-0206
-- -- -- Dept of Astronomy Fax: (206) 685-0403
-- -- -- Univ. of WA, Box 351580 Home: (206) 729-8340
-- -- -- Seattle, WA 98195-1580 dcr@astro.washington.edu
-- -- -- www-hpcc.astro.washington.edu/faculty/dcr